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(54) Insulated anchor or suspension clamp

(57) A metallic clamp housing 8 for a power-supply cable or fibre-optic cable 1 has a two part electrically insulating body 2 which extends beyond the ends of the housing. The gaps between the insulating body 2 are filled with silicone resin 6 to prevent tracking within the clamp. Annular grooves 5 may be provided on the body 2 to increase the creepage distance of the body. The housing 8 is hinged 9 and secured by a nut and bolt 11,12. The housing may be provided with two straining links 14 to form an anchor clamp or may be a suspension clamp (Fig. 4). As a suspension clamp the housing is of uniform cross-section not wedge shaped.

Fig.1

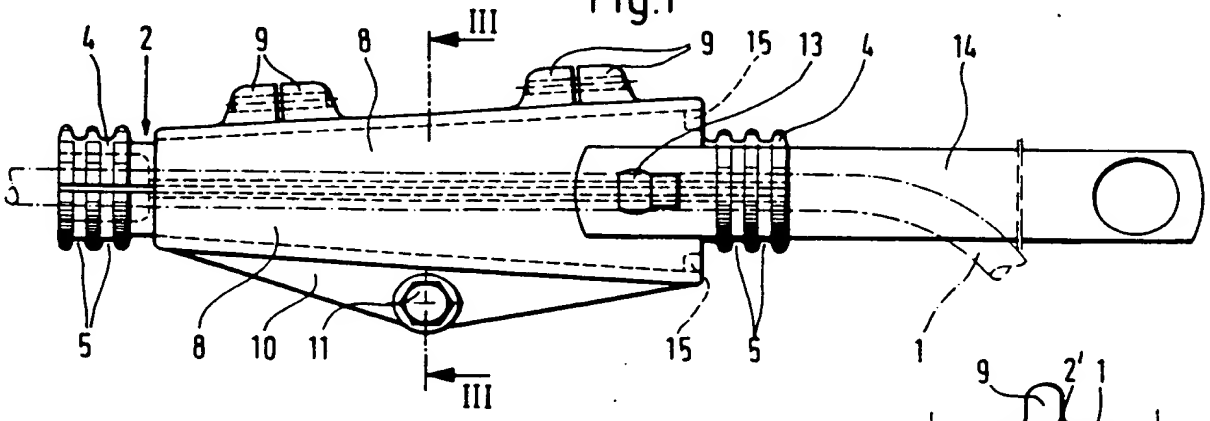
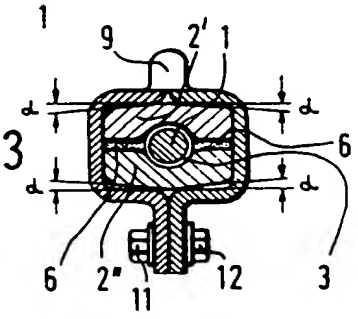


Fig.3



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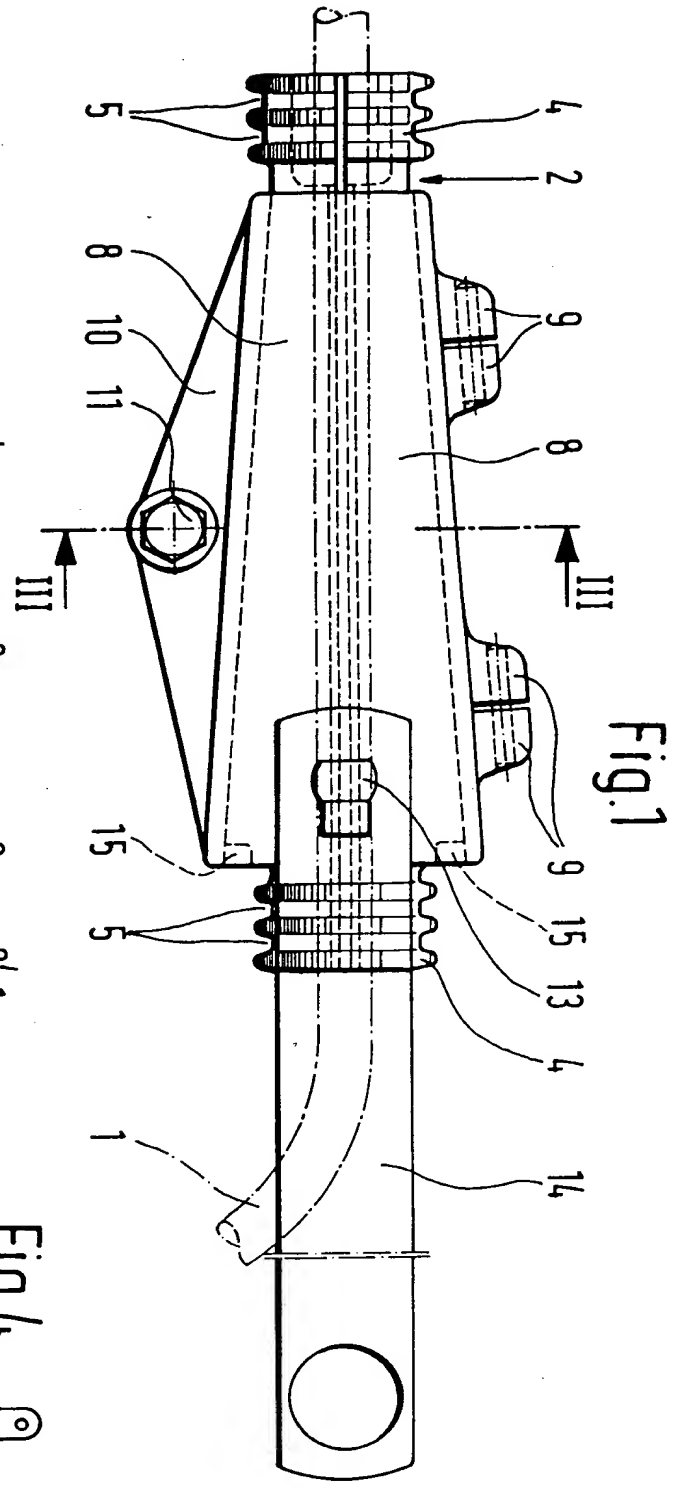

Fig.1

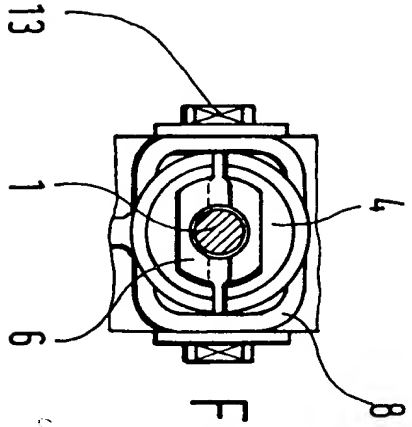

Fig.2

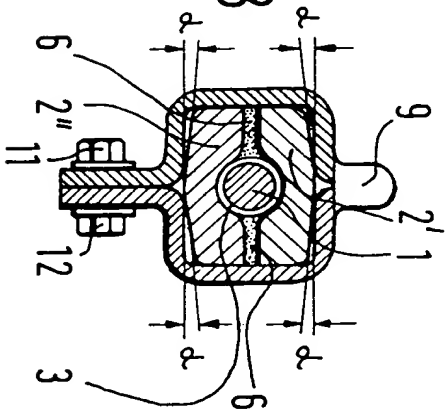

Fig.3

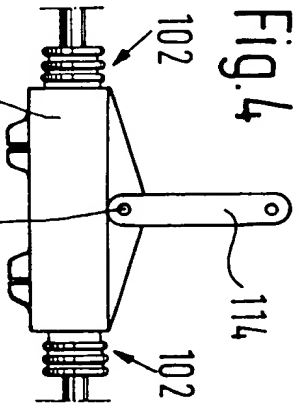

Fig.4

SPECIFICATION

Insulated anchor or suspension clamp

The invention concerns an insulated anchor or suspension clamp exhibiting the features described in the precharacterised portion of Patent Claim 1.

The known anchor clamps of this type are used for the staying of fully insulated overhead cables for low-voltage mains power supply systems, the construction of these clamps being such that there is a clamp cable duct within the clamp body for each phase conductor. These clamps do not need to meet high insulating power requirements, so that, in addition to designs in which the clamp cable ducts are formed solely by the clamp body, there are also designs in which the cores are clamped between the clamp bodies and the metallic housing, perhaps with an intermediate insulating foil.

The insulated low-voltage anchor clamps described above cannot be used for the staying of partly insulated high-voltage lines which, compared with bare overhead conductors, permit a smaller phase spacing thereby rendering possible a higher trace energy density, and which permit also shorter distances to buildings, trees and suchlike, thereby producing in addition a reduced line requirement. Instead, bare, or uninsulated, anchor and suspension clamps are used, with the result that an insulator must be mounted between these clamps and their anchorage or suspension points. Thus, the basic consideration was that, in order to achieve safe clamping of the partly insulated line, it is necessary for the clamp body to engage directly with the metallic conductor core, for which purpose the insulation is removed from the section of the conductors required for mounting the clamp. Following mounting of the clamp, a sealable insulation hood is inverted over the clamp in order to restore contact safety. The disadvantages of this system are the high installation expenditure, the cost-intensive stripping of the insulation, the additional insulator required and the hood, likewise required in addition to the clamp, together with the re-mounting of the clamp and the difficulty in adjusting sag.

The invention is based upon the task of creating a contact-safe anchor or suspension clamp which can be connected by means of an electrically non-insulated connecting fixture, ie., without the insertion of an insulator, to the mounting point, even where the latter is at earth potential. This task has resulted in the creation of a clamp having the characteristics described in Patent Claim 1.

Owing to the fact that the clamp body is constructed as an insulator which projects over the metallic housing, in the longitudinal direction of the cable duct, and gaps present in the clamp body are filled, so as to exclude air, by means of an electrically insulating material, the clamp constituting the subject-matter of the invention has both a high puncture strength and a high tracking resistance. In particular, even safe partial discharges to the metallic housing are avoided.

The clamping constituting the subject-matter of the invention is thus suitable both for partly insulated medium-voltage mains power supply conductors and for plastic-covered fibre optic cables. In the case of the latter, discharges to the metallic housing from the accumulated charge on the outer sheathing surface are likewise avoided. For this reason it is not necessary, as in the case of partly insulated medium-voltage mains power supply conductors, for the metallic housing to be connected to the associated fixed point by means of an insulator. Rather, the metallic housing can lie at earth potential and be thus connected, electrically conductive, for example by means of metal links, to the fixed point.

Where the clamp constituting the subject-matter of the invention is to be applied as an anchor clamp, the clamp body forms, in a manner known in the art, a wedge taper or cone which is located within a corresponding guide in the metallic housing, so that the binding force exerted by the split clamp body on the conductor within the cable duct is maintained by the tensile force in the longitudinal direction of the conductor, and increases as tensile force is increased. In the clamp constituting the subject-matter of the invention, the clamp body bears on the conductor insulating sheathing. Thus it is not necessary to remove this sheathing in order to mount the clamp, which is an important additional advantage of the clamp constituting the subject-matter of the invention. In order to increase the retaining strength of the anchor clamp, it is expedient to tooth the surfaces of the clamp body forming the cable duct, along the receiving direction of the cable duct, the depth of the teeth selected being such that the teeth only impress upon the conductor sheathing, without puncturing it.

Where the clamp is to be used as a suspension clamp, it is not necessary for the clamp body to form a wedge taper or cone, since there are no forces in the longitudinal direction of the conductor, or at least no significant forces, to be absorbed.

In order to achieve, on mounting the clamp, complete filling of the clamp body gaps with insulating material, and without the necessity for particular precision, the special design insulating material forms a shaped inlay, composed, on account of its good mechanical and electrical properties, of silicon rubber.

The insulators projecting over the metalllic housing are specially formed by the end sections of the clamp body. In order to increase creepage distance the outside sheathing surface of the insulators is expediently fitted with

annular grooves around the conductor.

The construction of the cable duct end and the section of the insulating material within it, as described in Patent Claim 6, provides, within certain limitations, for transverse movement of the conductor relative to the clamp body, which can occur for example, in vibration of the conductor, without the conductor and its sheathing being exposed to the danger of damage. Thus, in the case of an anchor clamp, the end into which the conductor enters in constructed in this way, and in the case of a suspension clamp, both ends are so constructed. Air locks in the end sections and at the junction with the central section of the clamp body are thus avoided by means of a clamp construction, as described in Patent Claim 7.

Using a housing and clamp construction as described in Patent Claim 8, the binding force exerted by the housing on the clamp body is applied virtually in the centre of the cable duct, thereby enabling the bending load of the plastic clamp body to be kept very small.

In order to provide maximum simplification in mounting of the clamp, a special design is used whereby the two halves of the housing are joined together by, at the least, one joint. All that is required is to clamp the two halves of the housing together, for example by means of a screw, after mounting on the clamp body, located diametrically to the joint or joints.

The following describes the invention in detail, using the design examples illustrated in the drawing. The illustrations are as follows:

Figure 1 a side view of a first design example,

Figure 2 an incomplete top view representation of the left-hand end of the first design example illustrated in Fig. 1,

Figure 3 a section along the line III–III of Fig. 1,

Figure 4 a side view of a second design example.

An anchor clamp for the staying of a plastic-sheathed fibre optic cable or a medium-voltage mains power supply conductor 1, has a clamp body 2 (Fig. 3) comprising the two identically constructed parts, 2′ and 2″, and composed of an electrically insulating plastic with a high electrical insulating capacity. Cast resin is used in the design example illustrated. As shown in Fig. 3, the two parts, 2′ and 2″ of the oblong clamp body 2 bound a centrally located clamp cable duct 3, which passes longitudinally through the clamp body. The curvature of the faces bounding the clamp cable duct 3 matches the outside diameter of the conductor 1. In addition, the depth of the two grooves in the parts 2′ and 2″ which form the clamp cable duct 3 has been selected so that there is a space between the two parts when the conductor 1 is located in the clamp cable duct 3. Teeth, not illustrated, in the grooves forming the clamp cable duct 3, and extending along the clamp cable duct, increase the retaining strength of the anchor clamp. The depth of these teeth has been selected so that they do not penetrate the sheathing of the conductor 1.

The central section of the clamp body 2 has a rectangular type profile, the depth of this profile decreasing gradually from one end of the central section to the other end, as shown in Fig. 1. The width, on the other hand, remains constant. The central section of the clamp body 2 thus forms a wedge. The two wedge surfaces are not level surfaces however, as shown by Fig. 3. On the contrary, the depth of the clamp body cross-section profile decreases, not only along the length of the clamp cable duct 3, but also from the centre towards both sides. The angle of inclination is only a few degrees, however, for example 10°.

The two end sections 4 of the clamp body 2, which are constructed so as to form a single part with the central section, have a circular cross-section shape, their outside sheathing surface having annular grooves 5 to extend creepage distance. In the end section 4 of the clamp body 2, shown on the left-hand side in Fig. 1, and into which enters the conductor 1, which is to be anchored, the diameter of the clamp cable duct 3 has been enlarged.

The cylidrical interspace between the inside sheathing surface of this enlargement of the clamp cable duct 3 and the outside sheathing surface of the conductor 1 is completely filled by one end section of a shaped inlay 6, which is composed of silicon rubber, and which also completely fills, without air inclusions, the two gaps on either side of the clamp cable duct 3 between the two parts 2′ and 2″ of the clamp body 2. The clamp body 2, together with the shaped inlay 6, thus forms an insulator which, for a partly insulated medium-voltage mains conductor, provides, in conjunction with the conductor insulation, the required insulation capacity, whilst in addition providing sufficiently long creepage distances for the occurring voltages and, in particular, preventing partial discharges and similar discharge phenomena in plastic sheathed fibre optic cables. In addition, the enlargement of the clamp cable duct 3 on the intake side and the filling of this enlargement using silicon rubber creates a soft conductor entry zone which prevents buckling of the conductor and provides for a limited amount of transverse movement.

The central section of the clamp body 2 is contained within a metallic housing 7 which, in the design example, is composed of a high-strength non-corroding aluminium alloy. The housing 8 is divided in a plane perpendicular to the dividing plane of the clamp body 2. As shown by Fig. 4 in particular, the two parts of the housing 8 are joined together above the

clamp cable duct 3 by means of two hinges 9, staggered longitudinally along the clamp cable duct, the swivelling axis of the hinges running in the longitudinal direction of the clamp cable duct 3. One section of each of the two hinges matches one half of the housing 8, with the other section matching the other half. Underneath the clamp cable duct 3 the two housing parts each form a flange 10 protruding downwards. In the design example shown, the depth of this flange increases towards the centre where there is a through bore, which accommodates a binding screw 11. The two halves of the housing 8 are clamped together by means of this binding screw 11 and a nut 12.

As shown in Fig. 3, the housing 8 has a rectangular cross-sectional shape, the depth decreasing, as shown by Fig. 1, from the housing end illustrated on the right-hand side in Fig. 1 to the other housing end, with the same wedge angle as the clamp body 2, whilst the width remains unchanged over the entire length of the housing. The inside profile of the housing 8 matches the width of the clamp body 2. The inside surfaces of the housing 8 which form the wedge guide for the clamp body 2, ie., the surfaces in Fig. 3 above and below the clamp body 2, each occupy one plane. This has the result that the housing 8 exerts on the clamp body 2 a binding force, directed against the clamp cable duct 3, above and below it only.

On the end section adjoining the outlet for the conductor 1, a side view of the housing 8 exhibits one pivot 13 for each of two straining links 14, composed of metal, for example sheet steel or aluminium plate.

To install the anchor clamp, the lower part 2" of the clamp body 2 is first mounted on the sheathing of the conductor 1. The shaped inlay 6, the slotted socket-type end section of which is located within the intake section, is then mounted on the upper side of the part 2". The part 2' of the clamp body 2 is then mounted on the shaped inlay 6. The housing 8 can then be mounted on the clamp body 2. The housing end having the smaller dimensions thus matches with the end of the clamp body 2 which has the smaller dimensions. This has the result, first and foremost, that the projection of the clamp body 2 over the housing 8 is greater on the anchorage side of the clamp than on the intake side. In order to achieve a defined output situation, starting cams 15 have been fitted at the end of the housing 2 having the larger diameter. These cams are located against the larger face of the two parts 2' and 2". Following mounting of the housing 8 on the clamp body 2 in this manner, the two parts are clamped together by means of the binding screw 11 and the nut 12. A binding force is thus exerted on the two parts 2' and 2" of the clamp body 2, and on the shaped inlay 6, in that there is a reduction of the gap between the parts 2' and 2". The conductor 1 is thereby anchored firmly and, in addition, the gaps are completely filled, without inclusion of air, by the shaped inlay 6. Tensile load can cause the projection of the clamp body 2 over the intake end of the housing 8 to be increased, thus also increasing the retaining strength.

The design example of a suspension clamp represented as in Fig. 4 differs essentially from the example shown in Figs. 1 to 3 only in the fact that neither the clamp body 102 nor the metallic housing 108 have a wedge form, or wedge-shaped guide. Instead, the cross-section dimensions of this example remain constant over the entire length of the housing and the entire length of the central section of the clamp body 102. The clamp is fixed to a fixed point by means of one or more links 114, through one end of which is located the screw 111 which clamps together the two halves of the housing 108. For further details, reference should be made to the description of the design example as illustrated in Figs. 1 to 3.

All the features contained in the above description, together with those features which may only be inferred from the drawing constitute, as elaborations, the subject matter of the invention, even if special references has not been made to them and, in particular, even if they have not been mentioned in the Patent Claims.

CLAIMS

1. Insulated anchor or suspension clamp having a metallic housing which can be affixed to a suspension device, and located within this housing a clamp body consisting of at least two sections and composed of an electrically insulating material forming, through the clamp body, a cable duct which accommodates a sheathed conductor, and characterized by the fact that there is connected to each end of the clamp body (2, 2', 2"; 102), each divided in the longitudinal direction of the clamp body and projecting over the metallic housing (8, 108) in the longitudinal direction of the cable duct, an insulator (4) surrounding the conductor, and that the gaps between the parts (2', 2") of the clamp body (2; 102) and the insulators (4) are filled over their entire length, and excluding air, with an electrically insulating material (6).

2. Clamp as in Claim 1, characterized by the fact that the material filling the gap forms a shaped inlay (6).

3. Clamp as in Claim 1 or 2, characterized by the fact that the material filling the gap is a silicon rubber.

4. Clamp as in any one of the Claims 1 to 3, characterized by the fact that the insulators are formed by the end sections (4) of the clamp body (2; 102).

5. Clamp as in any one of the Claims 1 to

4, characterized by the fact that the outer sheathing surface of the insulators have annular grooves (5) around the conductor (1).

6. Clamp as in any one of the Claims 1 to 5, characterized by the fact that the cable duct (3) possesses a section, at least in one insulator (4), having an enlarged diameter, in which is located a section of the electrically insulating material, filling the interspace between the inner wall of the insulator (4) and the outer sheathing surface of the conductor sheathing.

7. Clamp as in Claim 6, characterized by the fact that the section of the electrically insulating material filling the enlarged end section of the cable duct (3) is constructed so as to form one piece with the shaped inlay 6.

8. Clamp as in any one of the Claims 1 to 7, characterized by the fact that the metallic housing (8; 108) is divided in a plane through the longitudinal axis of the cable duct (3), lying perpendicular to the dividing plane of the two-part clamp body (2; 102) and that the outer surfaces of the two clamp body parts (2', 2") facing away from the dividing plane form apical angles with the locating faces of the housing (8; 108) facing the dividing plane, opening away from the dividing plane of the housing (8; 108).

9. Clamp as in any one of the Claims 1 to 8, characterized by the fact that the housing (8; 108) has, lying diametrically relative to the longitudinal axis of the cable duct (3), both a minimum of one swivel joint (9), with the joint axis lying parallel to the cable duct axis, and a clamping device (11, 12), clamping together the two parts of the housing.

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